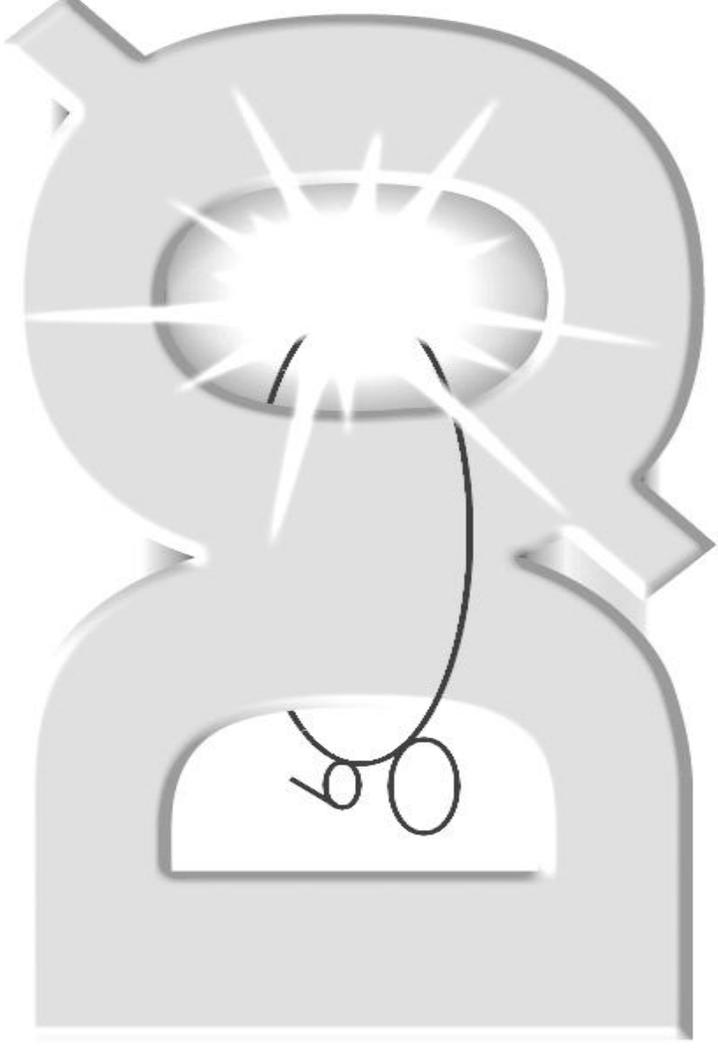


# Tevatron and DØ Status

- The Good, the Bad, and the Ugly -

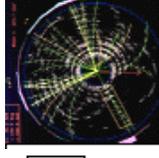


Arnd Meyer, RWTH Aachen  
DØ Deutschland Meeting  
March 14, 2003



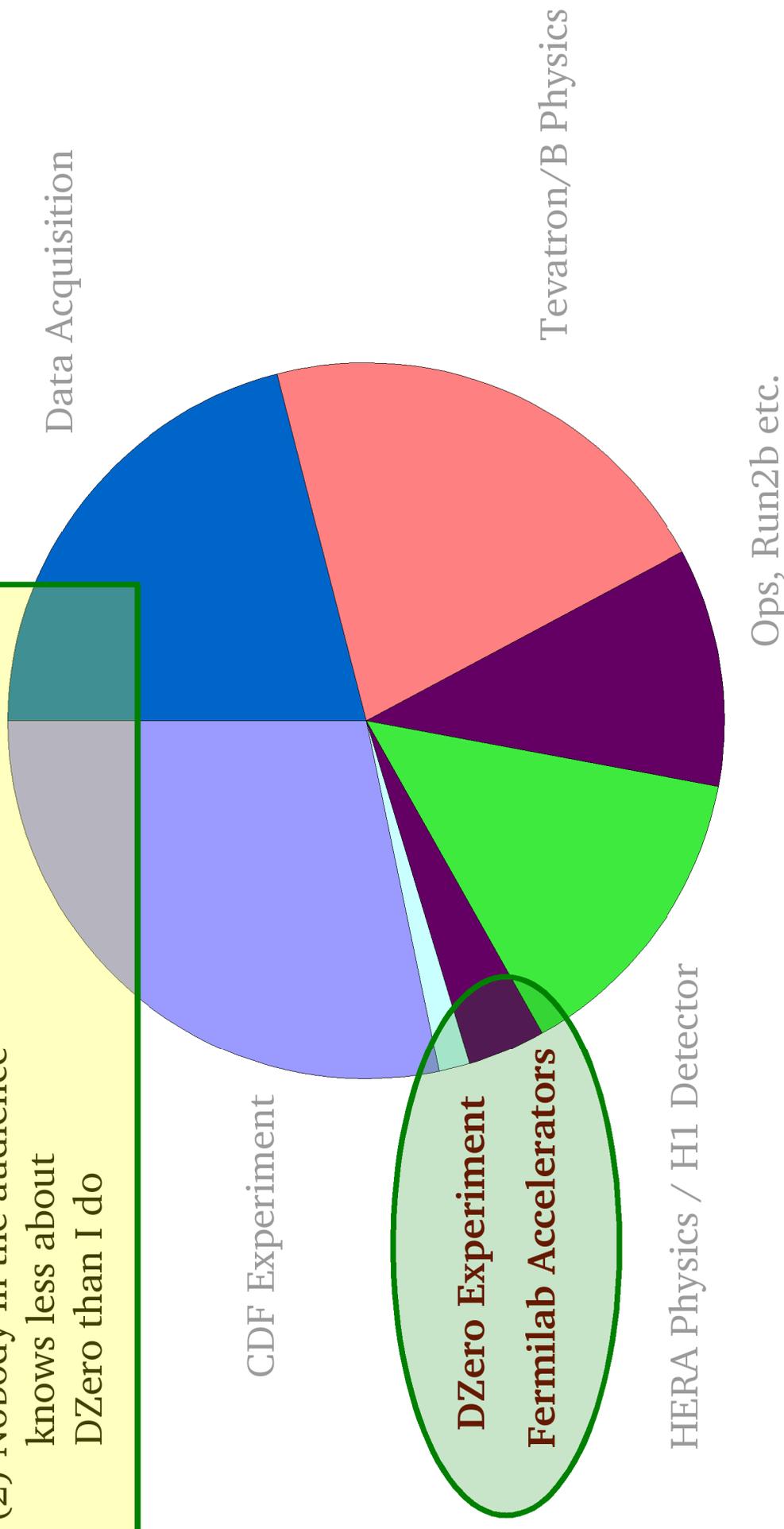
Fermi National Accelerator Laboratory

inquiring minds



## Assumptions:

- (1) Time required for questions/discussion  $\ll$  15min
- (2) Nobody in the audience knows less about DZero than I do

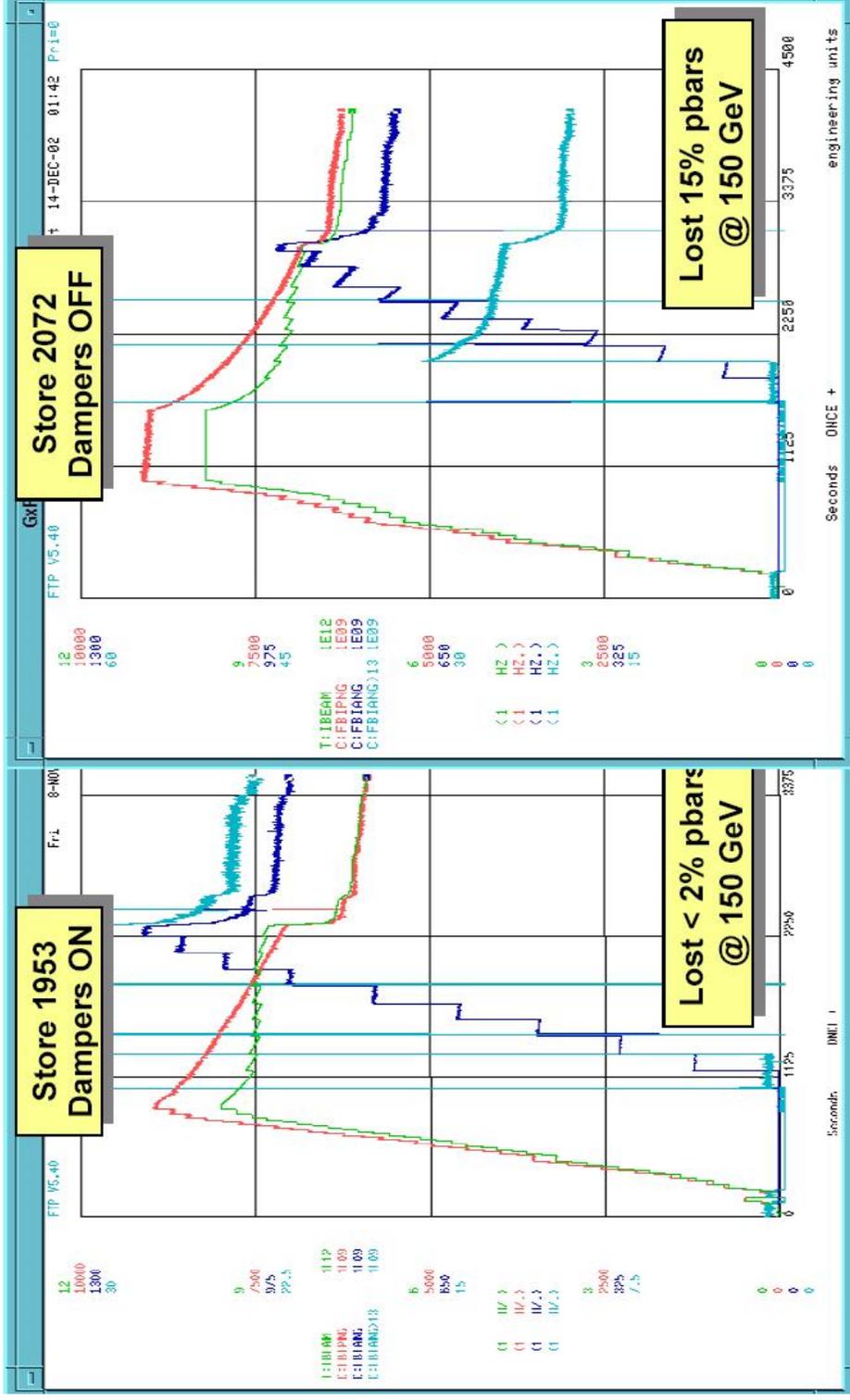




# Tevatron Dampers



## Lifetimes @ 150 GeV with/without dampers



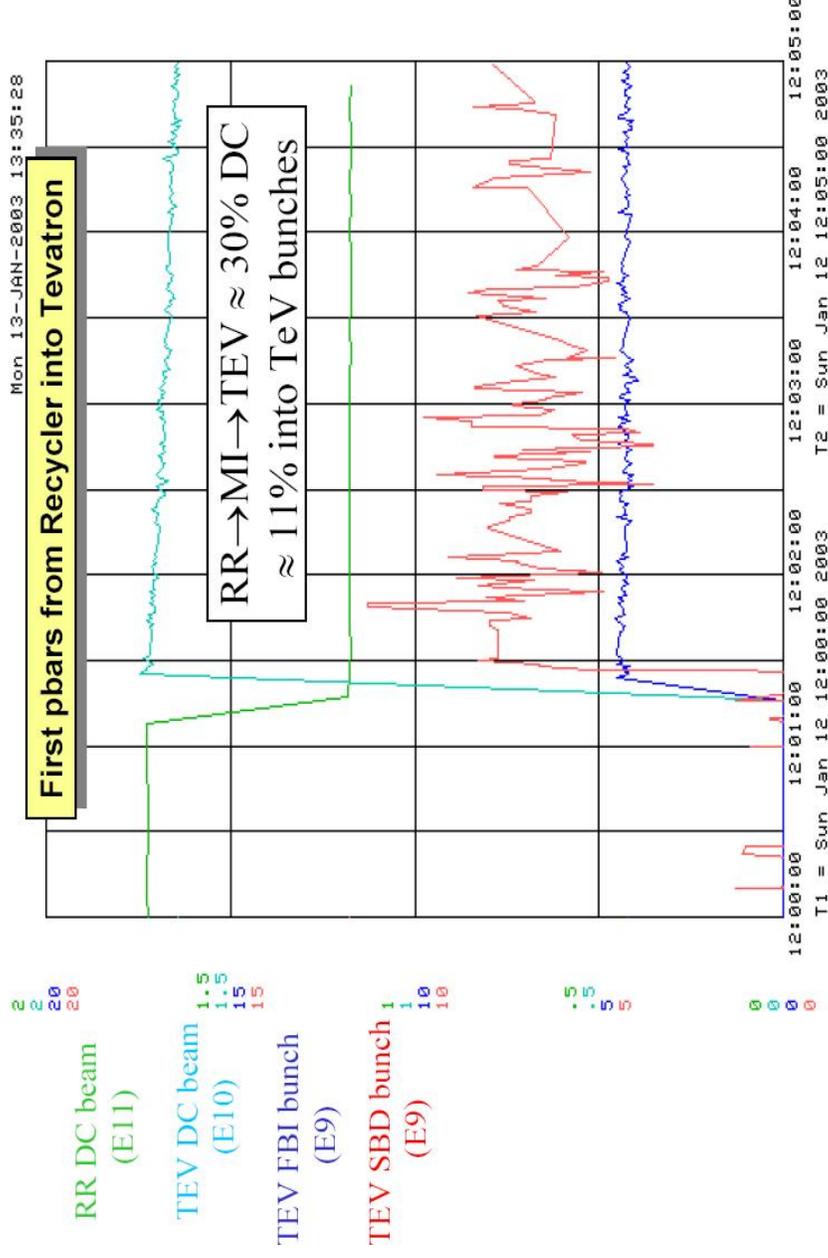
- Progress in commissioning and operation of Tevatron transverse dampers
- Tevatron longitudinal dampers recommissioned after shutdown



# First RR → Tevatron Transfer



- Remaining pbars after shot routinely used for Recycler commissioning
- First pbar transfer from RR into Tevatron on January 12<sup>th</sup>



**Recently reached *stashing* efficiency of 77%**



# January Shutdown

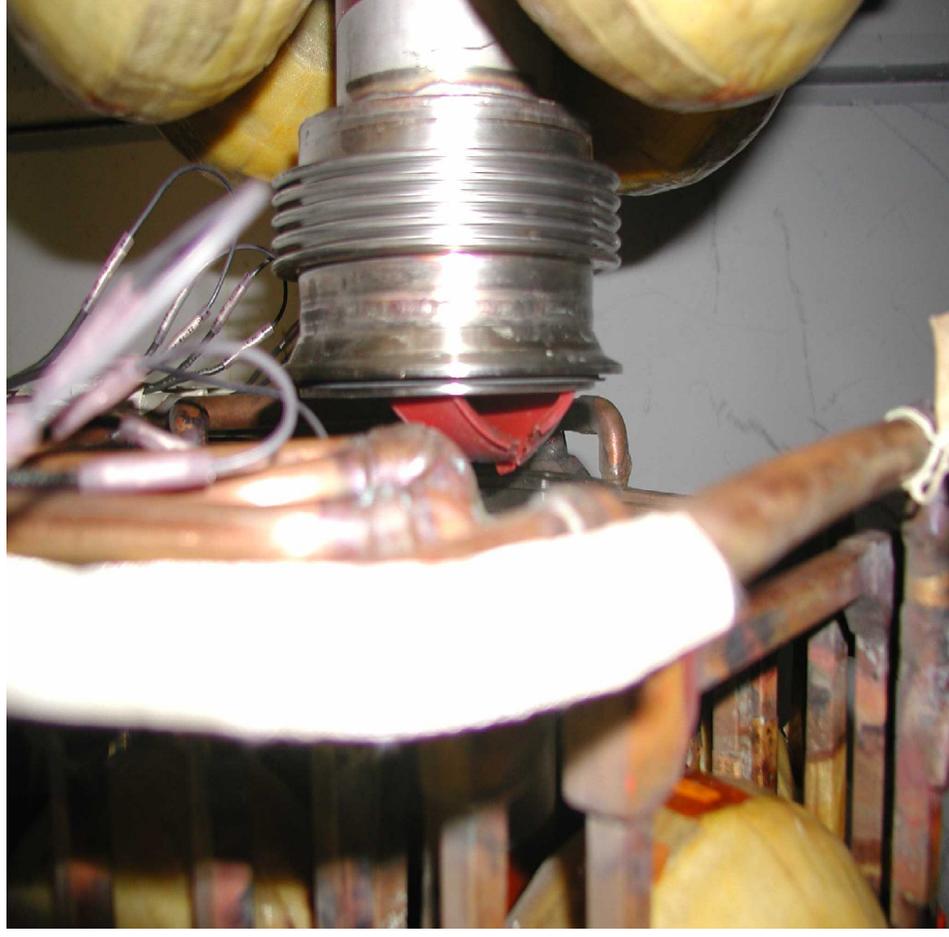
- Plan was 3.5 weeks beginning Jan 13
- Main tasks for Tevatron
  - ◆ **C0 Lambertson removal** (no longer needed, replace with larger aperture dipoles)  
→ maybe 10-15% improvement in luminosity (but new helix will require many shifts to commission)
  - ◆ **Alignment and stands**
  - ◆ **CDF shielding**
- Vacuum work on **Main Injector** and transfer lines
- **Recycler**: added vacuum pumps (40% of ring), remove transfer line windows, add instrumentation, alignment, ...
- **Proton Source / Booster**
  - ◆ Installed new Booster pulsed septum magnet → higher rep rate
  - ◆ Setting new intensity records now → MiniBoone's happy



Plastic beampipe cap  
removed on Jan 21



Believed to have been  
there for many years...



Expect slightly reduced pbar emittance growth

- Replaced four particularly deteriorated dipole stands in the Tevatron
- More to do in the future

## Tev A16-3 Dipole Photos



Tev A16-3 Upstream Stand

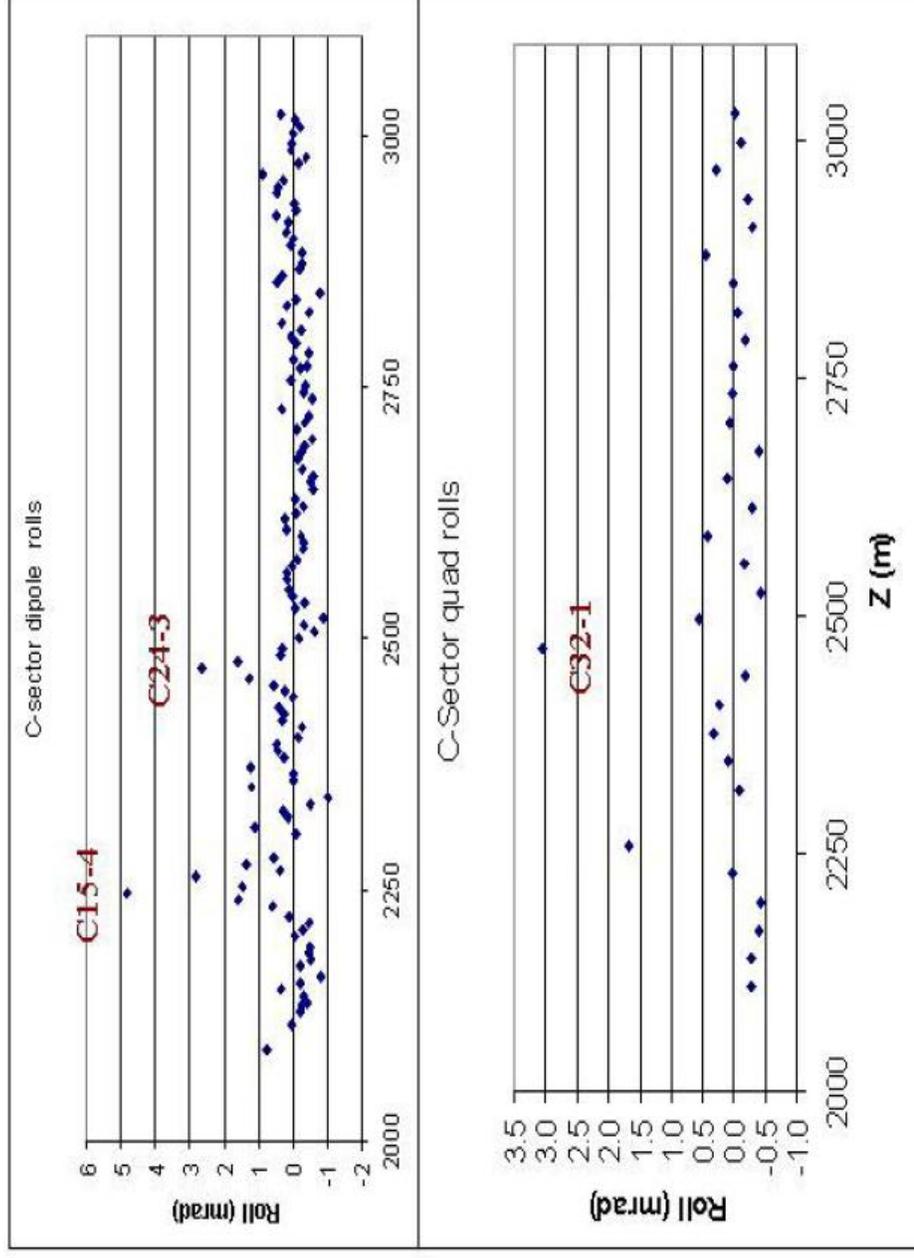




# Magnet Rolls



- Cataloged all magnet stands in the shutdown
- Realign later – some compensator magnets are running close to the limit





## After Shutdown... or not...



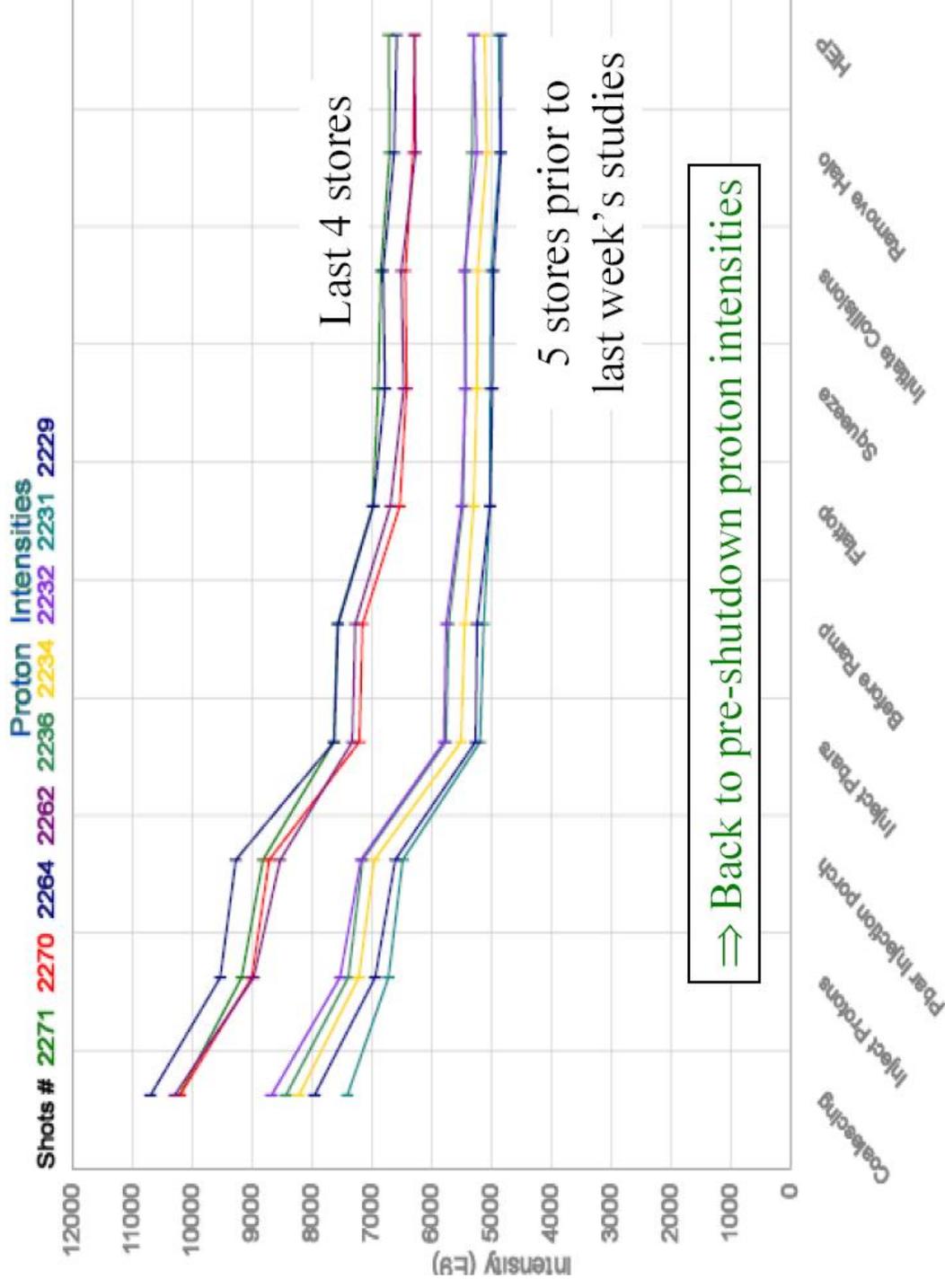
- Tevatron ready for beam on Feb 2nd, after very smooth start-up
- Developed ground fault in C-section, dipole component failure
- ◆ First store delayed to Feb 10, effective duration of the shutdown Jan 11 to Feb 10





# Startup After Shutdown

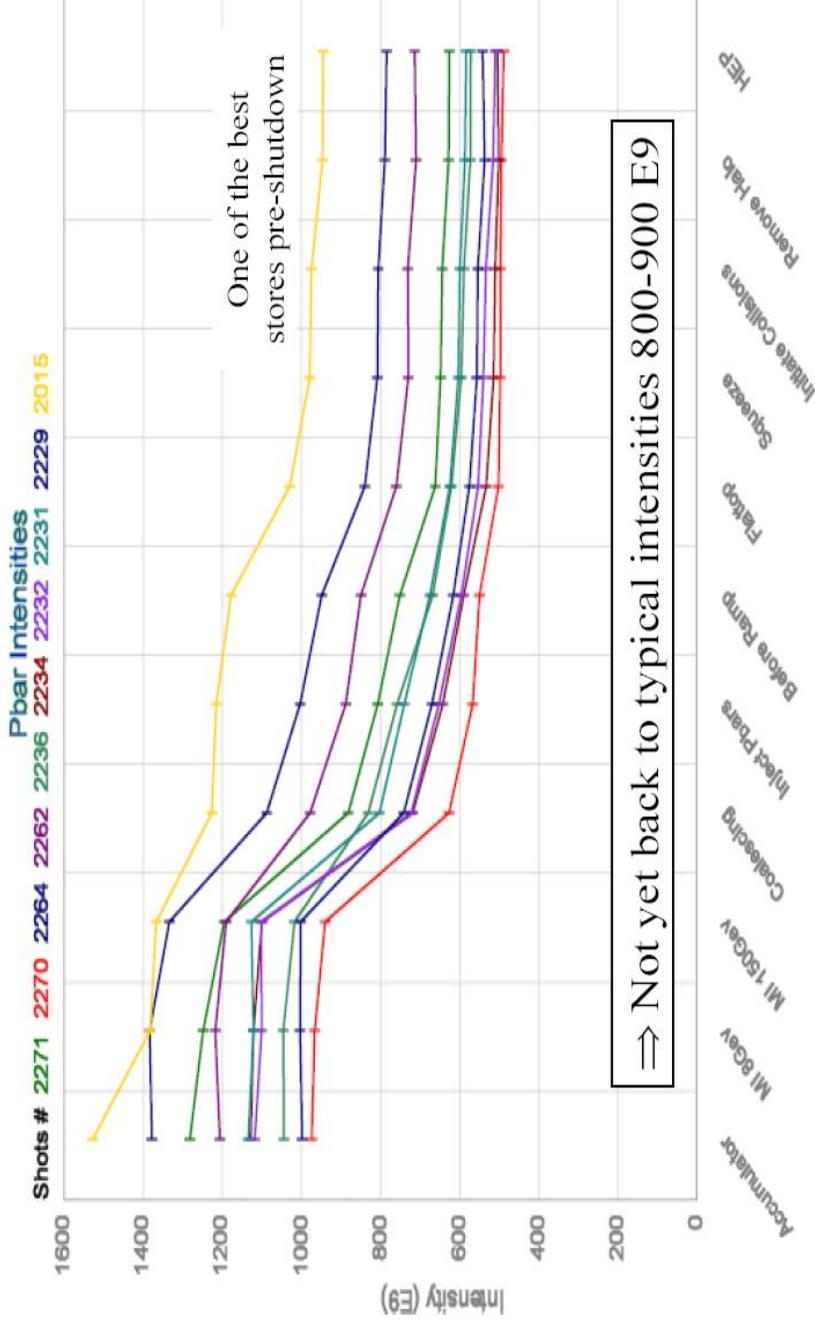
- Initial stores did not go smooth
- Proton intensity initially limited to avoid quenches early in the ramp





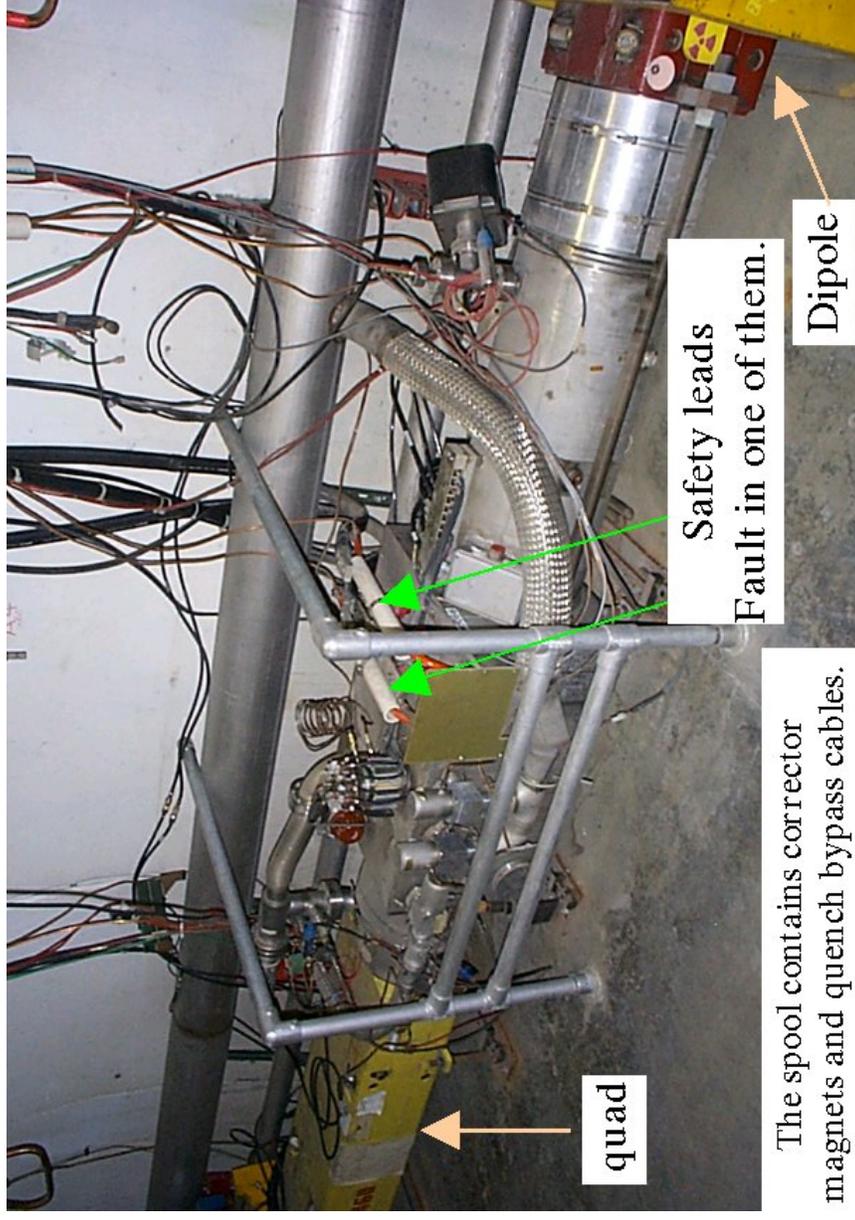
# Startup After Shutdown

- Still somewhat fewer antiprotons than pre-shutdown
- ◆ Shooting from smaller stacks
- ◆ Problems with ARF4 cavity causing higher loss of pbars



**Back to routinely stacking at up to ~10mA/hr**

- Ground fault developed at A1 on Sunday March 2
- Another week to warm up, investigate, cool down again
- Problem was with a spooling piece
- Used the opportunity to **fix magnet rolls** in the vicinity, and replace dipole with bad voltage tap
- Finally put a store in on Wednesday morning (March 12), with initial peak luminosity of  $2.7 \cdot 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$ , high losses. Store lost after 6 hrs.

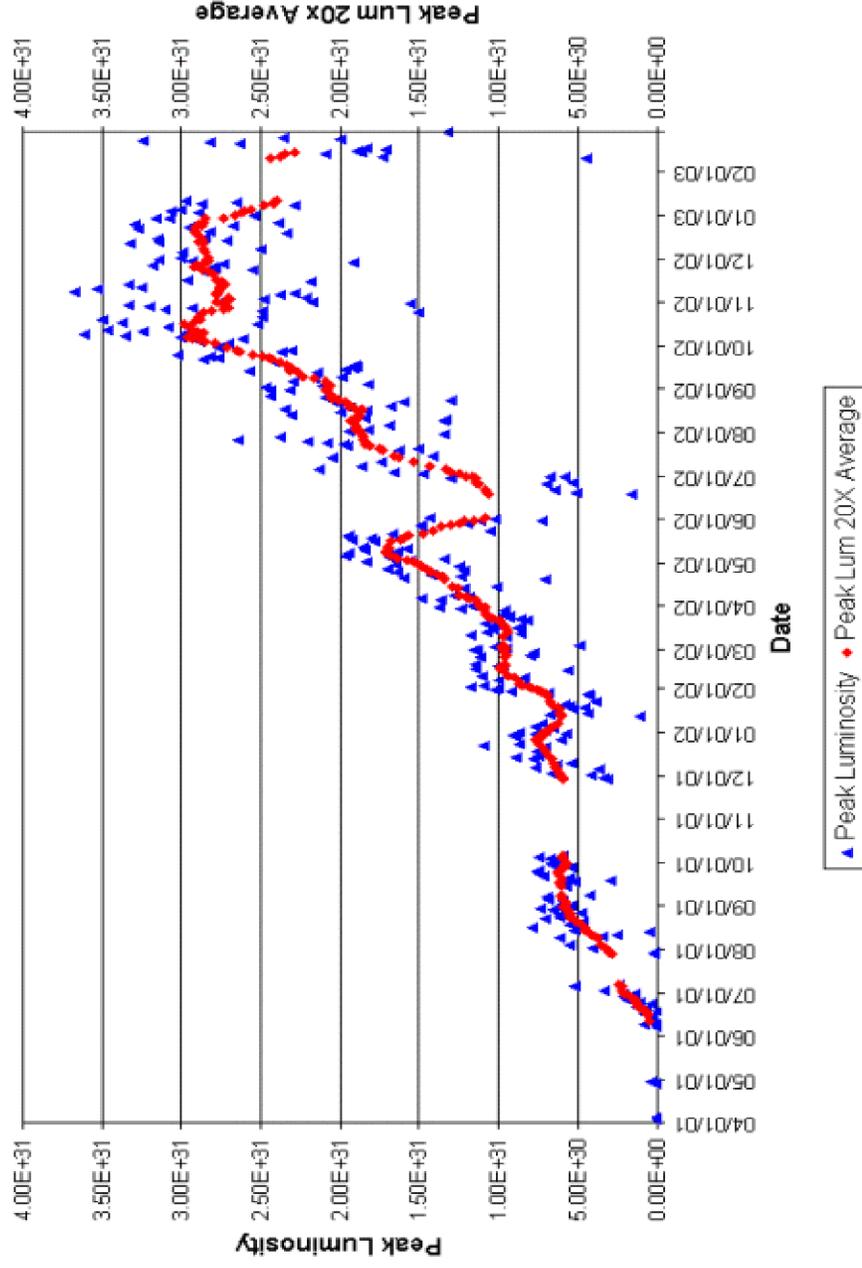




# Peak Luminosity



Collider Run IIA Peak Luminosity



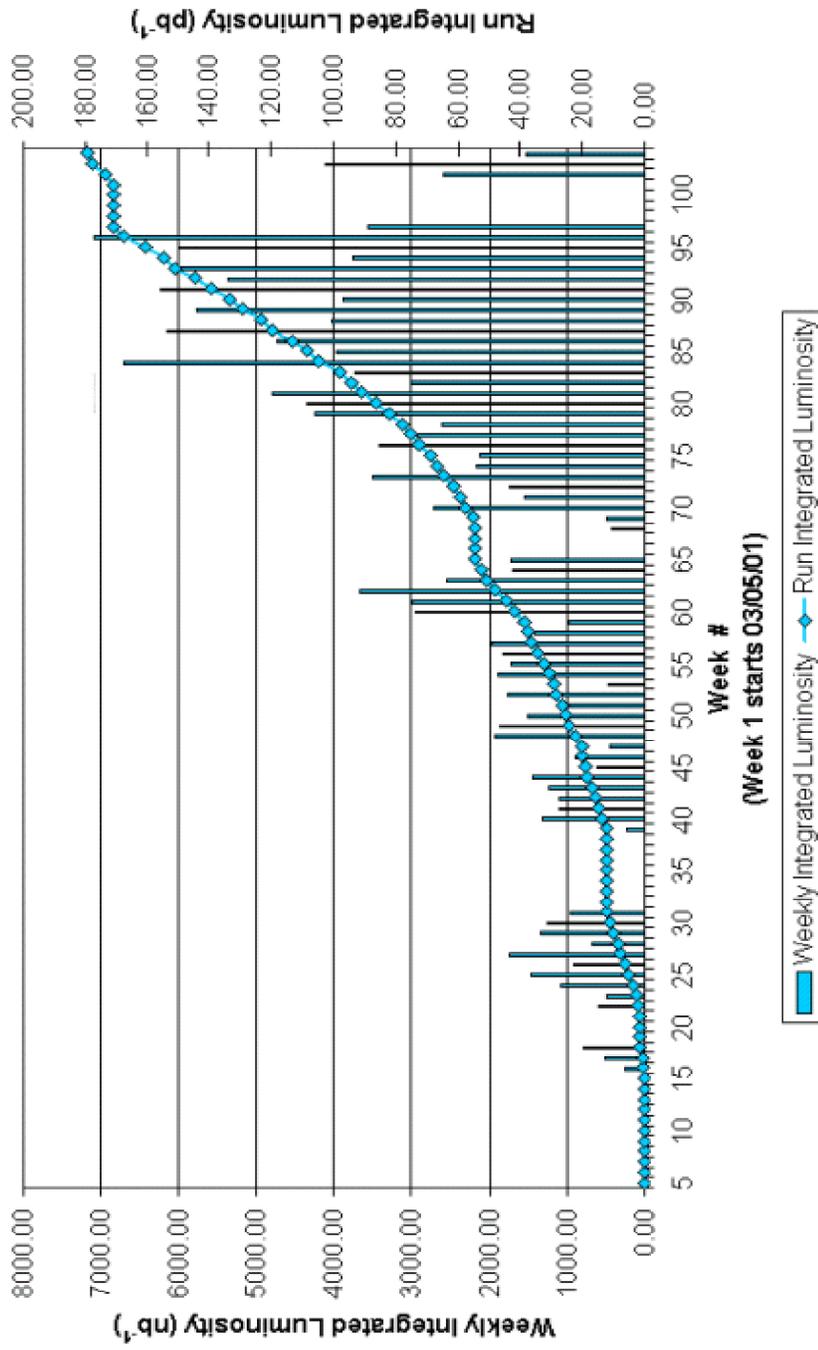
Peak luminosity  
reached plateau  
in October  
around  
 $3 \cdot 10^{31} \text{ cm}^{-2}\text{s}^{-1}$



# Integrated Luminosity



## Collider Run IIA Integrated Luminosity



6pb<sup>-1</sup> per week  
(no studies)

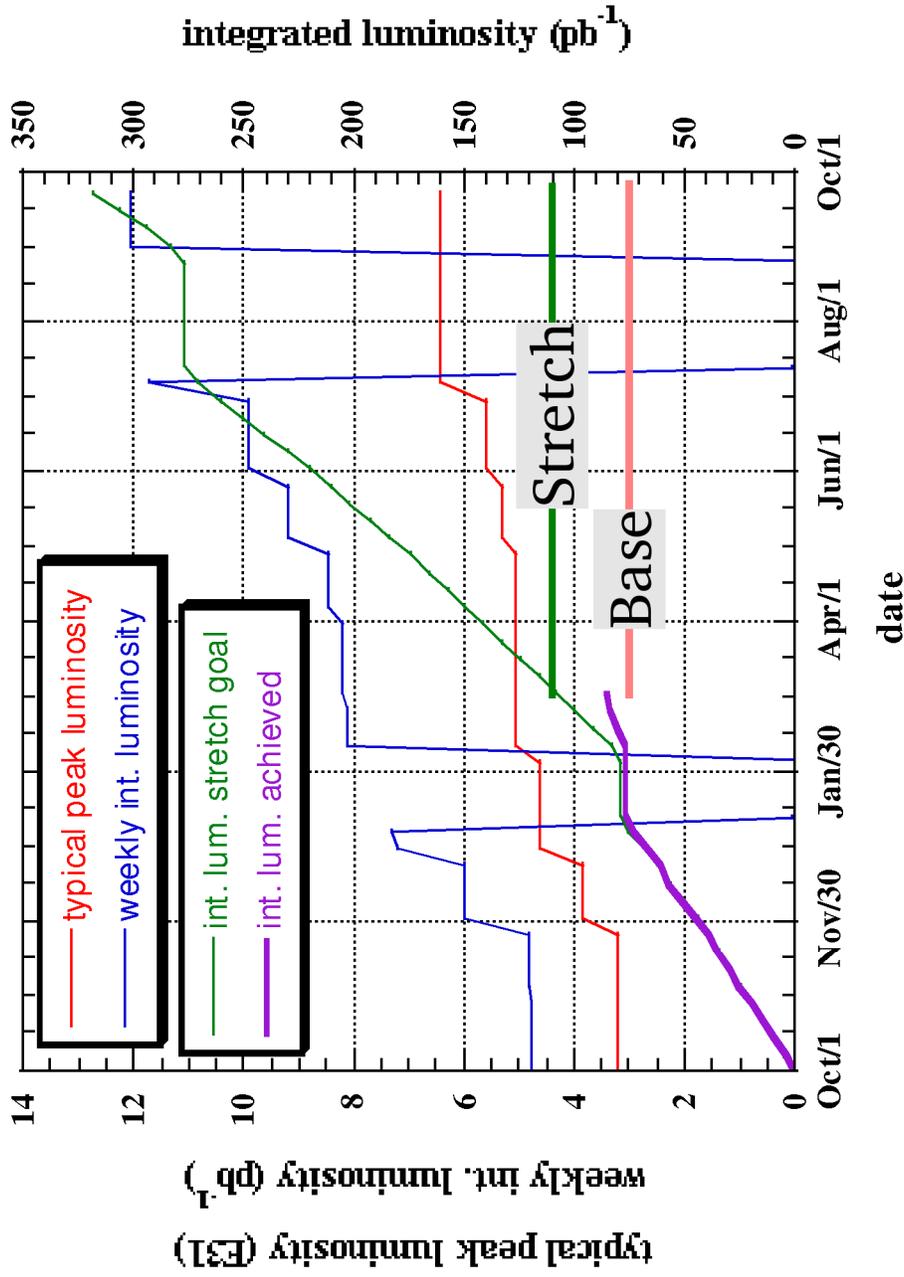
4pb<sup>-1</sup> per week  
(studies)

7pb<sup>-1</sup> best week  
(new year)



# FY 2003 Goals

## FY03 Luminosity and Stretch Goal



**Base goal = 220 $\text{pb}^{-1}$  in FY 2003**  
**Stretch goal = 320 $\text{pb}^{-1}$  in FY 2003**



- Accelerator Advisory Committee (Feb 4-6) charged to evaluate the path towards
  - ◆ peak luminosity of  $6-8 \cdot 10^{31} \text{ cm}^{-2} \text{ s}^{-1}$  by the end of September 2003
  - ◆ integrated luminosity of 220-320  $\text{pb}^{-1}$  in FY03
  - ◆ long-term goal of  $2-4 \cdot 10^{32} \text{ cm}^{-2} \text{ s}^{-1}$
- 320  $\text{pb}^{-1}$  will require a factor of 1.5 in weekly integrated luminosity
- Recommends to seriously consider abandoning the recycling of antiprotons
  - ◆ Loss in integrated luminosity would only be  $\sim 10\%$  (increase length of stores)
- Concerned about **spare situation** for many critical components, potentially causing downtimes of 3 months and more
- Concerned about the **large number of quenches**, reliability
- Several ambitious projects have to succeed in order to reach the long-term luminosity goals
  - ◆ Antiproton-production and -cooling, electron-cooling in the Recycler, Tevatron performance, ...
  - ◆ A failure in any of these cannot be compensated in other areas



# Accelerator Advisory Committee

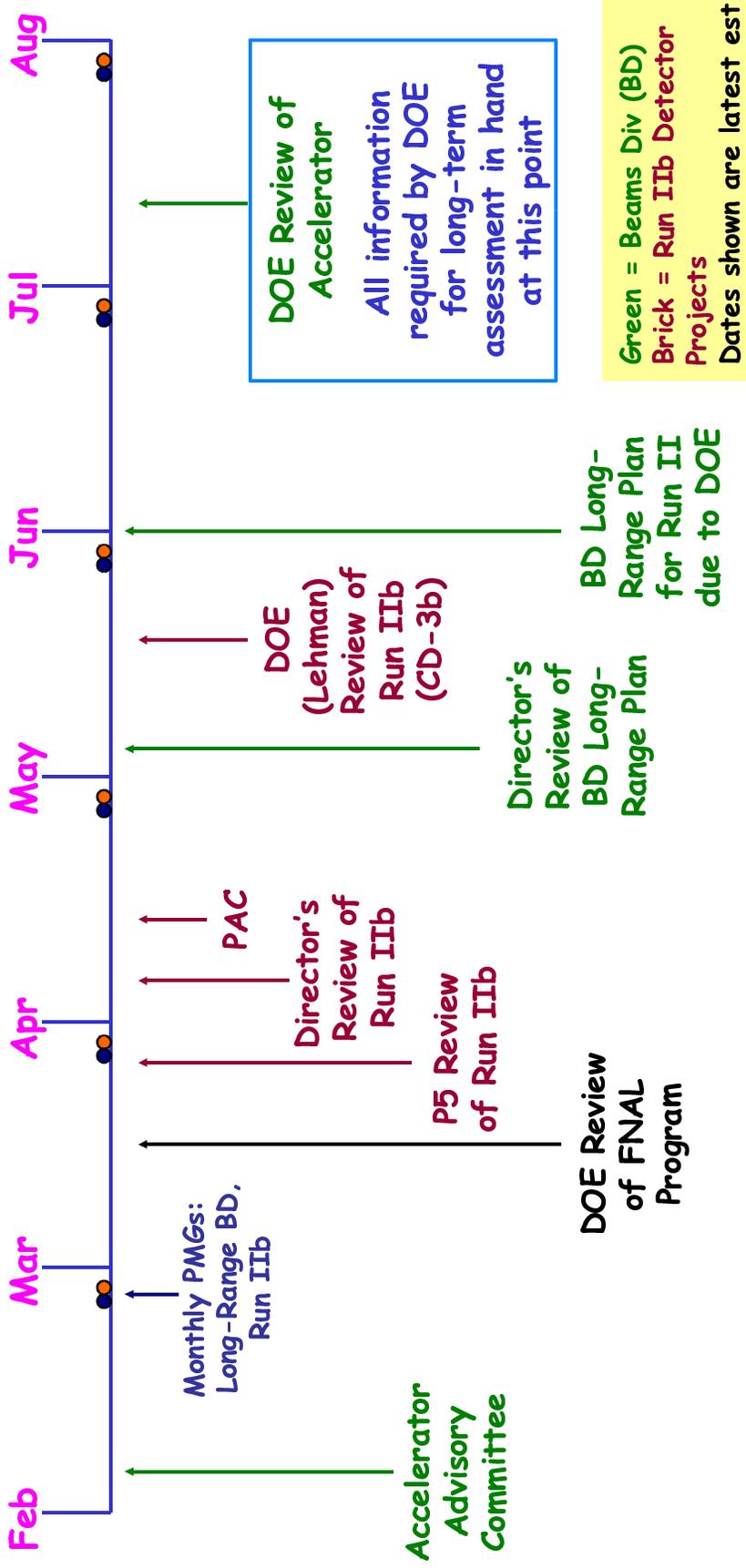


	Typical Run Ib	Run II Best store	Goal: FY03	Run II Target	
Peak Luminosity	1.6	3.7	6.6	33.0	$\times 10^{31} \text{ cm}^{-2} \text{ sec}^{-1}$
Integrated Luminosity	3.1	6.0	12.0	70.0	$\text{pb}^{-1}/\text{wk}$
Store hours per week	84	86	81	98	
Ave. Luminosity during stores	1.03	1.95	4.15	20.00	$\times 10^{31} \text{ cm}^{-2} \text{ sec}^{-1}$
Ave. pbars "burn rate" in D0 and CDF	0.60	1.13	2.41	11.60	$\times 10^{10}/\text{hr}$
Total pbars	33.6	91.0	113.0	486.0	$\times 10^{10}$
pbars "burn rate" / total pbars	0.018	0.012	0.021	0.024	/hr
Avg. Pbar Prod. Rate during stacking	4.2	6.9	11.0	40.0	$\times 10^{10}/\text{hr}$
Overall pbar "burn" efficiency	14.3	16.4	21.9	29.0	%

- Fraction of produced antiprotons used in collisions is only 16%



# Reviews...



**No end in sight...**

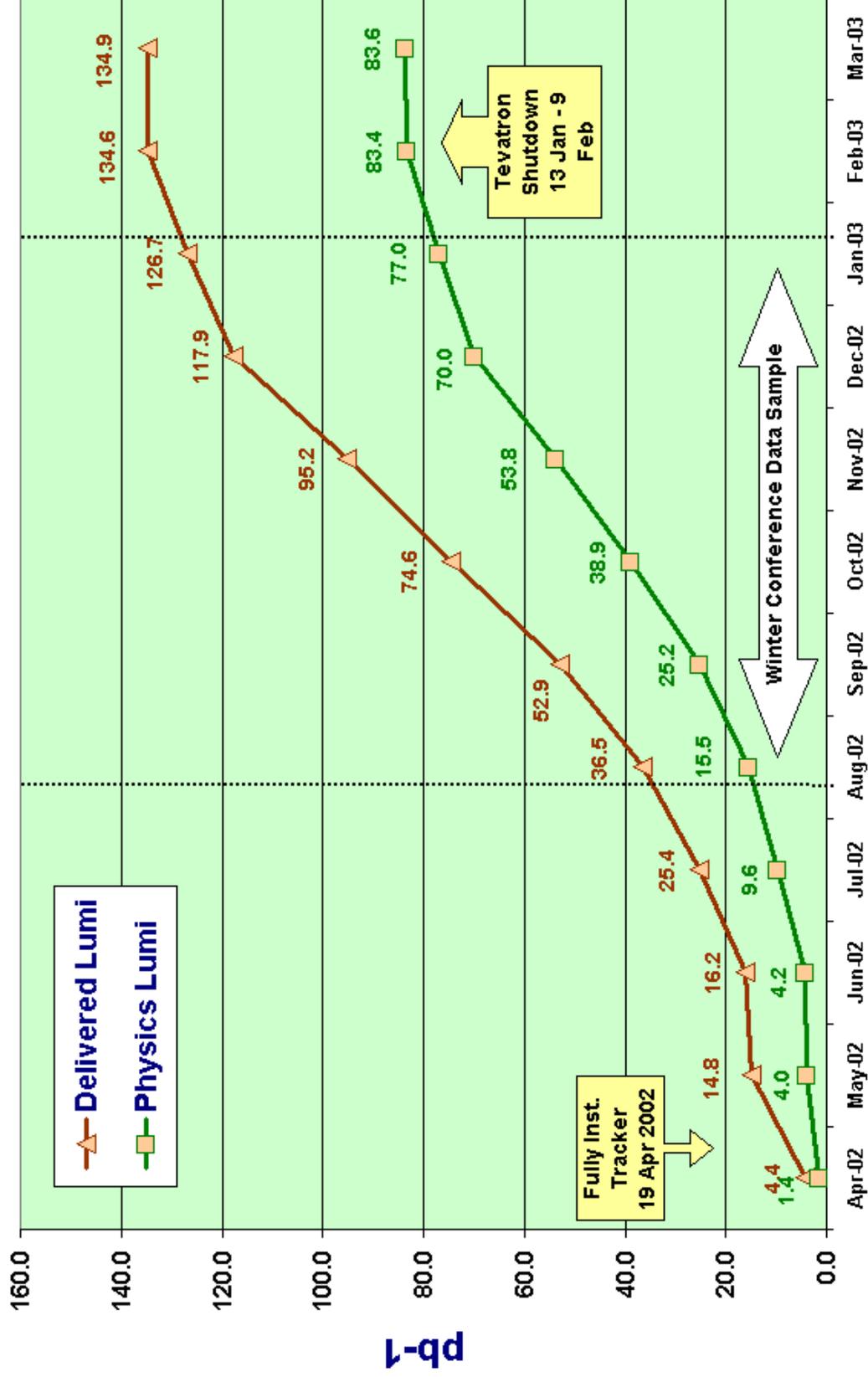


# Run II Bottom Line



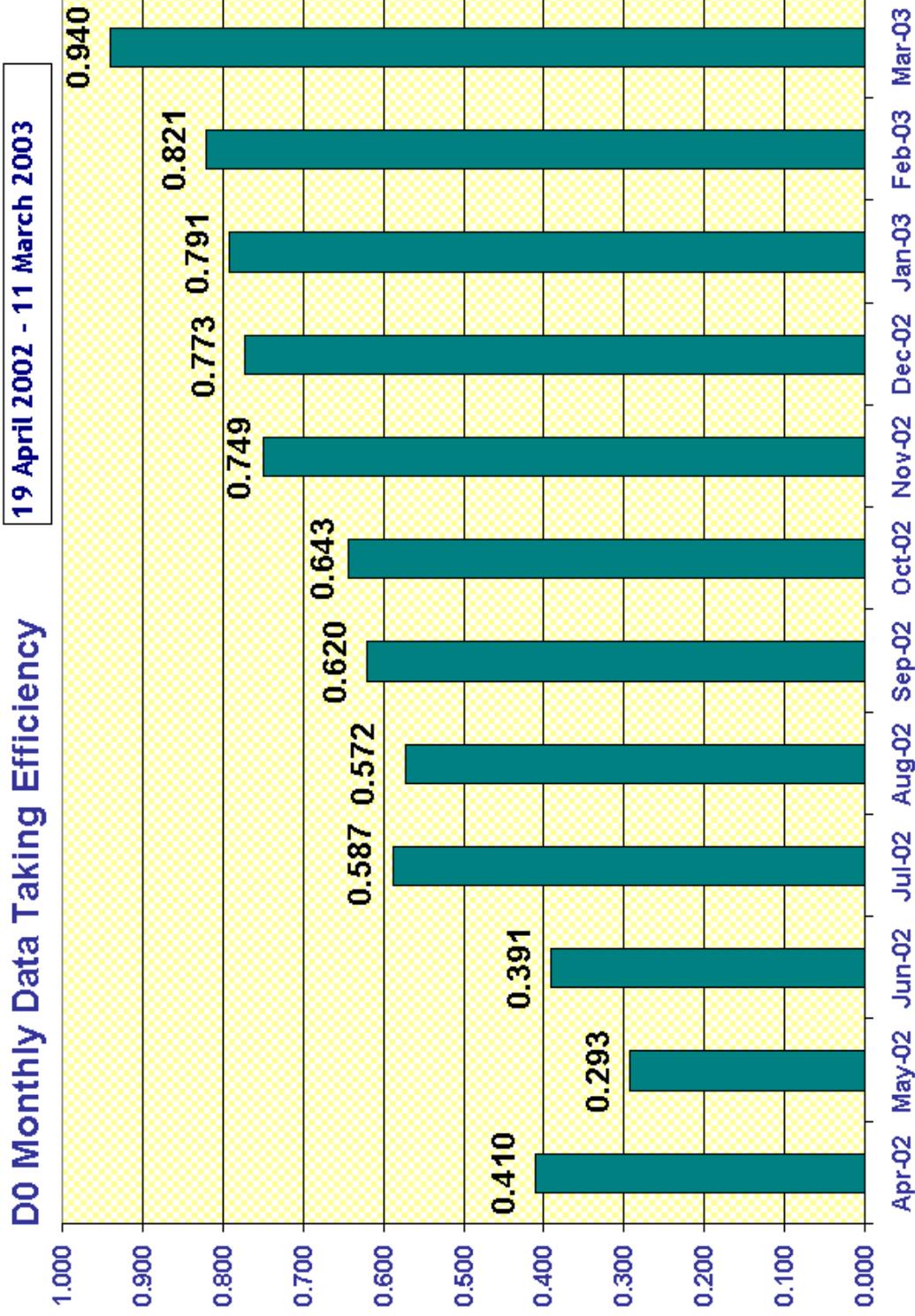
## D0 Integrated Luminosity

19 April 2002 - 11 March 2003





# Data Taking Efficiency

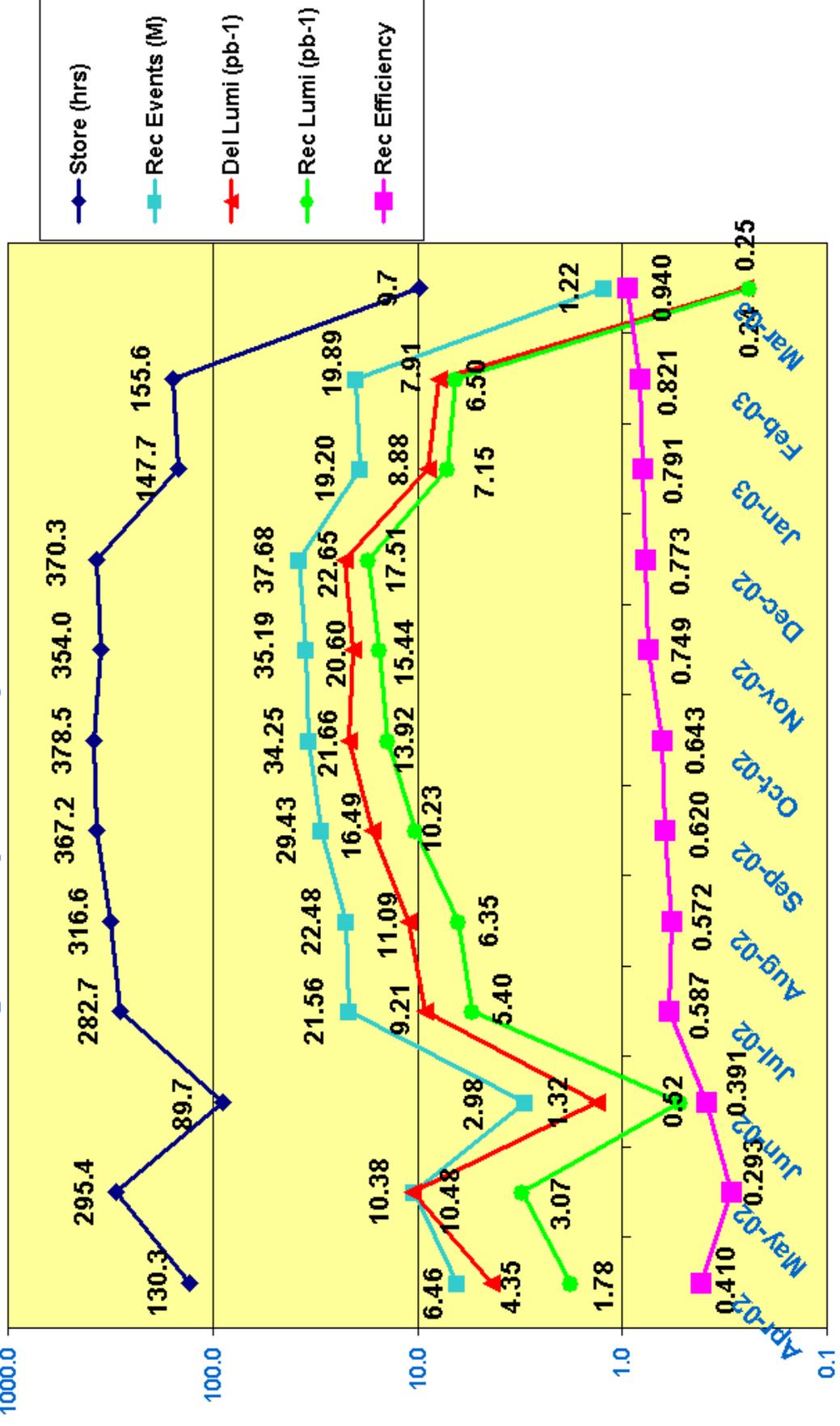




# Data Taking Summary



D0 Data Taking: Monthly Summary [19 April 2002 - 11 March 2003]





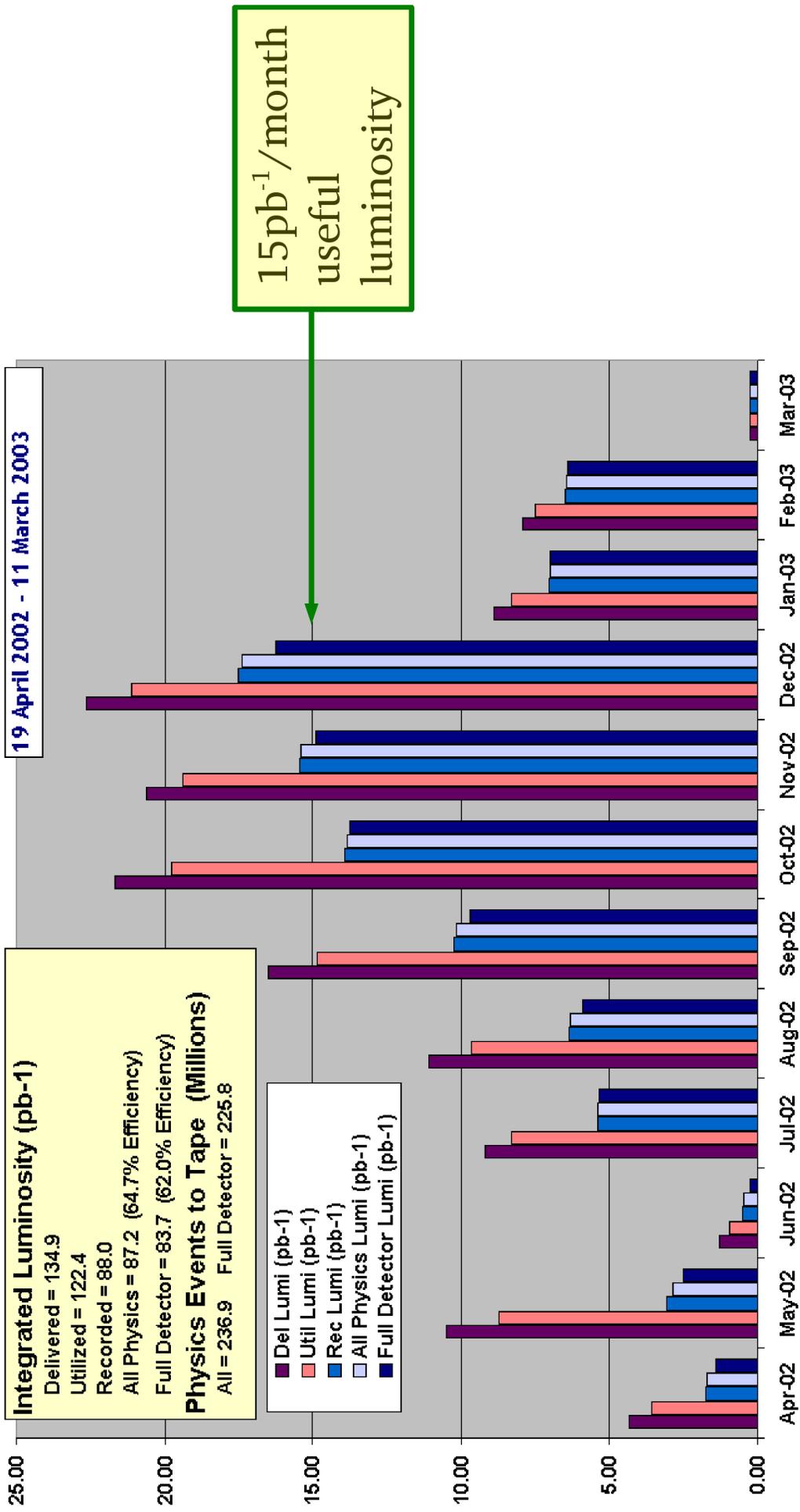
# Data Taking Efficiency

- Nice improvement in overall stability of the experiment
- Remaining 15% inefficiency due to
  - ◆ 5% front-end busy (→ code optimization, DZero decision)
  - ◆ 5% due to different minor problems (→ overall reliability)
  - ◆ 5% due to begin/end runs/stores (→ optimize procedures)
- ... but these numbers are hiding e.g.
  - ◆ Muon PDT firmware problem: lost  $\simeq 10\text{pb}^{-1}$  in November/December
  - ◆ wrong CFT calibration for  $\simeq 10\text{pb}^{-1}$  (December 19 to January 3) (recoverable)
- Counting from last summer:
  - $\simeq 100\text{pb}^{-1}$  delivered
  - $\simeq 70\text{pb}^{-1}$  “physics luminosity”
  - $\simeq 50\text{pb}^{-1}$  used in typical analysis

Hard to argue with the accelerator division about lack of reliability  
and low luminosity if we continue to throw away  
20-50% of the delivered luminosity!



# Impact of Shutdown (?)





# Detector Status

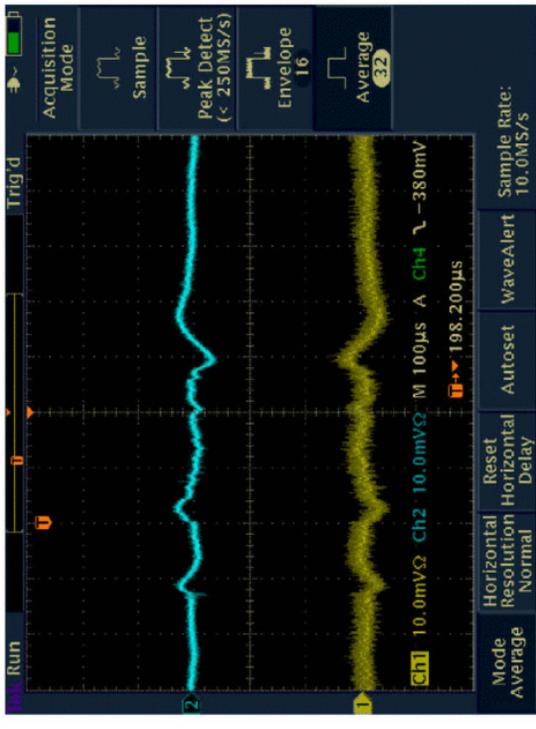
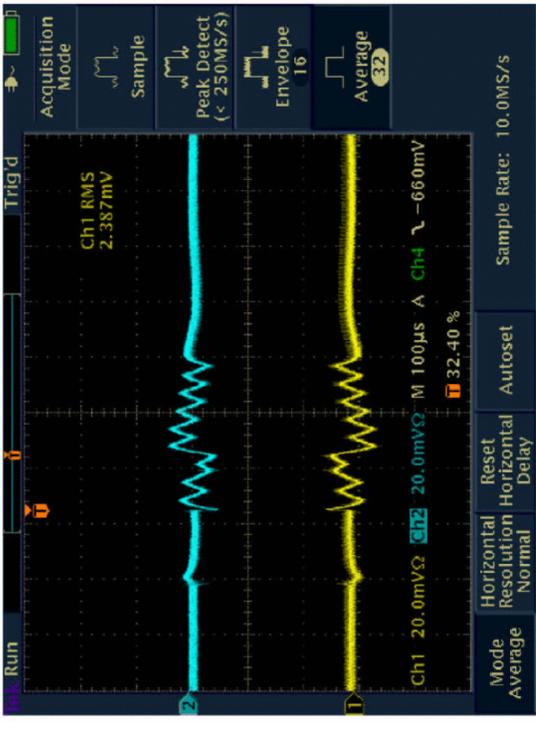
- **SMT and STT**
  - ◆ 88% → 92% operational (93% barrels, 95% F-disks, 86% H-disks), now  $\simeq$ 91%
- **CFT and CTT**
  - ◆ >99% of CFT channels operational, layer efficiencies  $\simeq$ 98%
  - ◆ CTT functional now, to be integrated into physics triggers
- **Preshower**
  - ◆ CPS shown to have >90% em efficiency with >20% fake rejection
  - ◆ FPS developing monitoring and reco tools
- **FPD**
  - ◆ Commissioning of AFE based electronics, to be included in DZero readout
- **Luminosity**
  - ◆ Not read out before maybe the end of the year (missing readout electronics) → little hope for luminosity uncertainty to go down soon from its present 10%



# Detector Status



- **Calorimeter and Calorimeter Trigger**
  - ◆ Less than 0.1% problematic channels
  - ◆ Modified 1500 BLS boards (reducing trigger noise by factor of  $\approx 2$ )
  - ◆ Replaced pre-amp fans (preemptive measure, 3 failures last year)
  - ◆ Cal trigger eta coverage will go from 2.4  $\rightarrow$  3.2 very soon (boards installed during shutdown)
- **Muons and Muon Trigger**
  - ◆ Fix broken wires in MDTs
  - ◆ Fix PDT FE code crashes (had been affecting D0 data taking for many months) and MDT Lost-Sync errors
  - ◆ Improvements at Level 2: efficiency for medium  $\mu$   
before 88%  $\rightarrow$  new LUT 93%  $\rightarrow$  better code 98%
  - ◆ Added L3 muon filtering



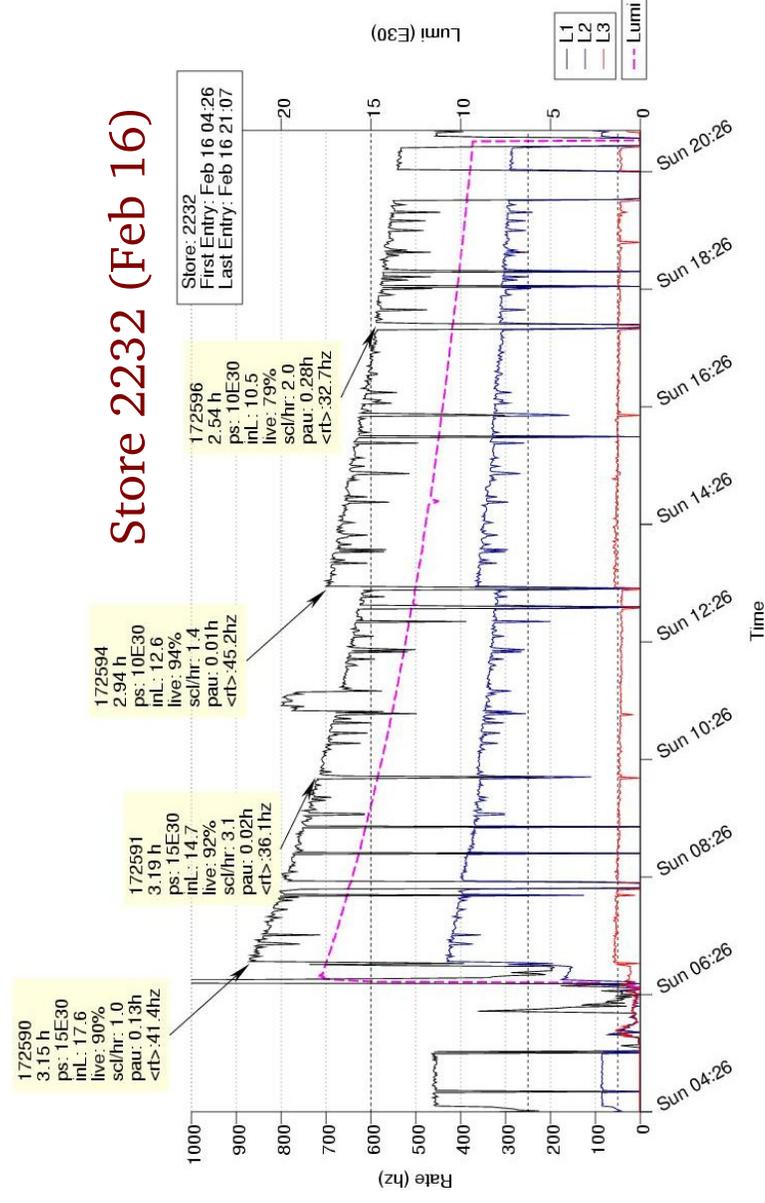
7mV correspond to  $\approx 1\text{GeV}$  in  $E_T$



# Detector Status



- **Level 2**
  - ◆ Upgraded to no lock step mode → L1 accept rates up to  $\approx 2.5\text{kHz}$  (if other components supported it)
- **Trigger**
  - ◆ present rate caps at 1100/600/50Hz for L1/L2/L3 (was 600/250/50Hz in December)
  - ◆ “Fast z” requirement (few % inefficiency) recently removed from most triggers
- **Present limitations**
  - ◆ Silicon readout
  - ◆ PDT readout ( $\approx 600\text{Hz}$ )
  - ◆ CFT readout





# Summary



- Much progress in accelerator operation and improvements
- Has not yet translated into more integrated (or even peak) luminosity
  - ◆ Peak luminosity hasn't exceeded last November's record stores
  - ◆ Integrated luminosity improved because of higher reliability / fewer studies in December
- Usual slow accelerator startup after shutdown
  - ◆ Not much data added since the “Moriond” data sample ( $50\text{pb}^{-1}$ )
- DZero taking data with a pretty much complete detector at 80-85% efficiency
- Can probably expect  $15\text{-}20\text{pb}^{-1}$ /month in integrated luminosity for summer